Curriculum Vitæ Sept. 13th, 2004 **Stephen S. Bullock**

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National Institute of Standards and Technology
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EXPERIENCE

Title/Program	Employer	Years
National Research Council (NRC) Postdoc, mathematics	National Institute of Standards and Technology	Summer2003-present
Term Assistant Professor, mathematics	University of Michigan	Fall2000-Summer2003
Teaching-Research Assistant	Cornell University	Fall98-Spring00
Teaching Assistant	Notre Dame University	1996-97 academic year
Teaching Assistant	Cornell University	Fall94-Spring96

RESEARCH INTERESTS

- quantum circuits models for quantum computing; quantum logic synthesis
  - quantum logic synthesis using exotic *KAK* metadecompositions arising from globally symmetric geometries $SU(2^n)/K$
  - synthesis with measurement using Hermitian density matrix formalism
- entanglement theory and implications for quantum circuit design

EDUCATION

Degree	University	Awarded	comment
Ph.D.	Cornell University	May, 2000	mathematics, under Birgit Speh
M.A.	Cornell University	August, 1996	differential geometry
B.S.	University of Georgia	June 1994	summa cum laude, $\Phi\beta\kappa$

MATHEMATICAL SPECIALTIES

Lie Groups, Lie Theory

- Structure theory of real groups, Satake & Vogan diagrams, representation theory
- Locally symmetric Riemannian manifolds

Riemannian geometry and smooth topology

- de Rham cohomology, sheaf cohomology, Lie algebra cohomology, Hodge theory
- nonpositive curvature, esp. locally symmetric Riemannian manifolds

PAPERS & PREPRINTS

"Stability of Global Entanglement in Thermal States of Spin Chains," joint with Gavin K. Brennen (first author,) `http://www.arxiv.org/abs/quant-ph/0406064`, to appear in *Physical Review A*.

"Note on the Khaneja Glaser Decomposition," *Quantum Information and Computation*, vol. 4, no. 5, 396, (2004).

"Recognizing Small-Circuit Structure in Two-Qubit Operators," joint with Vivek V. Shende, University of Michigan and Igor L. Markov, U.Michigan E.E.C.S., *Physical Review A* vol. 70, 012310, (2004).

"On Universal Gate Libraries and Generic Minimal Two-qubit Quantum Circuits," joint with Vivek V. Shende, University of Michigan and Igor L. Markov, U.Michigan E.E.C.S., *Physical Review A* vol. 69, 062321 (2004).

"Canonical Decompositions of n-qubit Quantum Computations and Concurrence," joint with Gavin K. Brennen, *Journal of Mathematical Physics*, vol. 45(6), 2447, May 2004.

"Smaller Circuits for Arbitrary n-qubit Diagonal Computations," joint with Igor L. Markov, *Quantum Information and Computation*, vol. 4, no. 1, 027, (2004).

"An Arbitrary Two-qubit Computation in 23 **Elementary Gates,"** joint with Igor Markov, *Physical Review A* vol. 68(1), 012318, July 2003.

"Unreduced Gaussian weighted L_2 cohomology of locally symmetric spaces," *New York Journal of Mathematics*, vol.8, 2002, pp. 241-256.

"Weighted L_2 cohomology of asymptotically hyperbolic manifolds," *New York Journal of Mathematics*, vol.7, 2001, pp. 7-15.

DRAFTS

"Criteria for Exact Qudit Universality," joint with first authors Dianne P. O'Leary, UMd.CP computer science and `N.I.S.T.` applied math, and Gavin Brennen (div. 842,) `http://www.arXiv.org/abs/quant-ph/0407223`.

"QR Factorizations Using a Restricted Set of Rotations," joint with Dianne P. O'Leary, UMd.CP computer science and `N.I.S.T.` applied math, available at `http://math.nist.gov/~SBullock`.

"Time Reversal and *n*-qubit Canonical Decompositions," joint with Gavin K. Brennen, `N.I.S.T.` atomic physics and joint with Dianne P. O'Leary, UMd.CP computer science and `N.I.S.T.` applied math, `http://www.arXiv.org/abs/quant-ph/0402051`.

INVITED TALKS & COMPUTER SCIENCE CONFERENCE PAPERS

Title	Coauthors	Venue	Date
Matrix decompositions & quantum circuit design	Vivek Shende (a) Igor Markov (a)	2nd Feynman Festival	August 21, 2004
Time-reversal symmetry and entangled eigenstates	Gavin Brennen (p) Dianne O'Leary (a)	UMdCP Quantum Info. & Coherence Seminar	May 4, 2004
Time-reversal symmetry and concurrence dynamics	Gavin Brennen Dianne O'Leary	NIST QuIBEC seminar, radiation physics	April 21, 2004
"Entanglement Capacity of *n*-qubit Quantum Computations"	Gavin Brennen	SPIE symposium, QC&Iii www.spie.org	April 13, 2004
"Finding Small Two-qubit Circuits"	Igor Markov Vivek Shende	SPIE symposium, QC&Iii www.spie.org	April 14, 2004
Time-reversal and the CCD matrix decomposition	Gavin Brennen Dianne O'Leary	NIST QuITaP seminar Math.Comp.Sci.Div.	March 25, 2004
KAK decompositions & entanglement dynamics	-	Cornell Lie Theory seminar	March 5, 2004
Gaussian weighted L_2 cohomology	-	Loc.Sym.Space Conf. M.F.Oberwolfach	Oct. 3, 2003
Symmetry Groups of the n-tangle and Maximal Concurrence	Gavin Brennen	Institute for Defense Analyses, CSS	Sept. 8, 2003
"An Arbitrary Two-Qubit Quantum Computation in 23 gates"	Igor Markov	Design Automation Conf. (www.dac.com)	July 2003 **B.P.A. nominee**
Weighted L_2 cohomology	-	**AMS** midwest section meeting, d.g. session	March 2002

COMPUTER SKILLS

Proficient: LaTeX 2ε, C++, RedHat Linux, Maple

Familiar: MatLab, html

REFERENCES

Isabel Beichl (superviser) .....isabel.beichl@nist.gov
Birgit Speh (thesis adviser, pure mathematician) .....speh@math.cornell.edu
Dianne O'Leary (applied mathematician) .....oleary@cs.umd.edu
Igor Markov (computer scientist) .....imarkov@eecs.umich.edu
Bei Lok Hu (physicist) .....hub@physics.umd.edu

MISCELLANY

Hobbies: jogging, investing, vegetable gardening.

Languages: English, German

Citizenship: USA